Water 81-82

GB
1025
S383.A6
v.1981/82
WATERSUP
GW-Local

Santa Clara Valley Water District

GB1025 S383A6 1981/82c.5

SANTA CLARA VALLEY WATER DISTRICT

WATER CONDITIONS ANNUAL REPORT

by

Isabel S. Gloege, P. E.
Associate Civil Engineer
Water Quality Section
Water Supply Planning Division

Edwin E. Ferguson
Head, Water Facilities Branch
Water Supply

Richard Pardini, P. E.
Division Engineer
Water Supply Planning Division

John T. O'Halloran
General Manager

David K. Gill
Water Supply Manager

DISTRICT BOARD OF DIRECTORS

Joe Pandit	District 1	James J. Lenihan	District 5
Patrick T. Ferraro	District 2	Sig Sanchez	At Large
Robert W. Gross, Chairman	District 3	Audrey H. Fisher	At Large
Joseph H. Donohue, Vice Chairman	District 4		

21R136tp

TABLE OF CONTENTS

		Page
I.	SUMMARY OF 1981-82 WATER CONDITIONS	1
II.	INTRODUCTION	2
III.	HYDROLOGIC BALANCE	4
IV.	WATER SUPPLY	11
	A. Groundwater	11
	Groundwater Recharge	13
	Land Surface Subsidence	13
	B. Precipitation	14
	Weather Modification	16
	C. Imported Water	17
	South Bay Aqueduct	17
	Hetch Hetchy	19
	San Felipe Project Status	19
	D. Water Conservation	19
	Local Storage Reservoirs	20
	Water Reclamation	20
	Water Reclamation Facility, Palo Alto	21
	Water Reclamation Facility, Gilroy	22
	Water Reclamation Study, Santa Clara Valley	22
	Water Savings Program	22
V.	WATER QUALITY	24
	A. Streams	24
	B. Reservoirs	25
	C. Groundwater Quality	25
VI.	GLOSSARY	28

TABLES

1.	Water Use Summary - Santa Clara Valley Groundwater Subbasin	9
2.	Reservoir Storage on October 1, 1981 and September 30, 1982	21

I. SUMMARY OF 1981-82 WATER CONDITIONS

During the period October 1, 1981 through September 30, 1982, precipitation was above average in the Santa Clara Valley, Coyote and Llagas Subbasins. As a consequence, the volume of groundwater in storage in the subbasins increased over the previous year. The Santa Clara Valley subbasin at the end of 1981-82 showed an increase in the volume of groundwater in storage of 83 thousand acre-feet (102 million[1/] cubic metres). In the Coyote Groundwater Subbasin, the volume of water in storage increased by ten thousand acre-feet (12 million cubic metres) and the Llagas Groundwater Subbasin showed an increase of 49 thousand acre-feet (60 million cubic metres).

The volume of water stored in the District's conservation reservoirs increased during the same period by 47 thousand acre-feet (58 million cubic metres). All the reservoirs filled and spilled during the period of the report except Stevens Creek Reservoir.

During the 1982 fiscal year, the District imported 96 thousand acre-feet (119 million cubic metres) of water through the South Bay Aqueduct. The Rinconada Water Treatment Plant treated 45 thousand acre-feet (55 million cubic metres) of this water the Penitencia Water Treatment Plant treated 23 thousand acre-feet (28 million cubic metres). Twenty-nine thousand acre-feet (36 million cubic metres) were released for groundwater recharge or direct use. Hetch Hetchy deliveries to Santa Clara County amounted to 59 thousand acre-feet (73 million cubic metres) during 1980-81.

Significant subsidence has been effectively halted since 1969. This is the result of groundwater levels having risen above and having remained above the critical pressure elevation.

1/ One million cubic metres = 1×10^6 cubic metres
1×10^6 cubic metres = 811 acre-feet
1 acre-foot = 1,233.5 cubic metres

II. INTRODUCTION

One aspect of the District's water resources management program includes monitoring and evaluating water use and water supplies, analyzing and updating projected water needs, and planning and implementing projects to meet the needs of the County. A major objective of the management program is to coordinate and optimize the use of the District's total water supplies, including local surface water, groundwater, imported water, and reclaimed wastewater. This aspect is the subject of this annual report which covers the period from October 1, 1981 to September 30, 1982. Its purpose is to inform the District Board of Directors and interested citizens of the condition of the County's water resources. The report deals with all the components of the hydrologic cycle.

The three major groundwater subbasins within the District are the Santa Clara Valley, Coyote, and Llagas Subbasins and are shown on Plate 1. They are interconnected and occupy about 375 square miles (970 square kilometres) or nearly 30 percent of the total County area. Groundwater supplies about half of the total water used in the Santa Clara Valley Subbasin and almost all of that used in the Coyote and Llagas Subbasins. The remainder is supplied from local surface diversions and imported sources.

Zones of benefit have been established for the conservation, importation, treatment and distribution of water used in Santa Clara County and are shown on Plate 1.

Zone W-2 encompasses the Santa Clara Valley Groundwater Subbasin and was formed for the registration of those groundwater producing facilities that benefit from recharge of the groundwater basin by the District with local and imported water. In this zone, a charge is levied for groundwater extracted and the revenue thus derived is used to support the District's conservation and importation program.

Two major sources of water supply income are the groundwater charge levied in Zone W-2 and the sale of treated water. The groundwater charge for nonagricultural uses during 1981-82 was $70 an acre-foot ($57 per thousand cubic metres). For agricultural uses the groundwater charge was $17 an acre-foot ($14 per thousand cubic

metres). Treated water was sold at $130 an acre-foot ($105 per thousand cubic metres), with water in excess of contracted amounts sold at $86 an acre-foot ($70 per thousand cubic metres).

In 1981-82, the District received about one third of its revenue from ad valorem property taxes including a portion of the one percent Countywide tax revenue as allocated by the County Assessor in accordance with State Senate Bill 154. In addition to the allocation, the District levied taxes in Zone W-1 to pay debt service on general obligation bonds authorized in 1963 and levied a State Water Project Tax throughout the County to pay for a portion of the costs of importing water from the State through the South Bay Aqueduct.

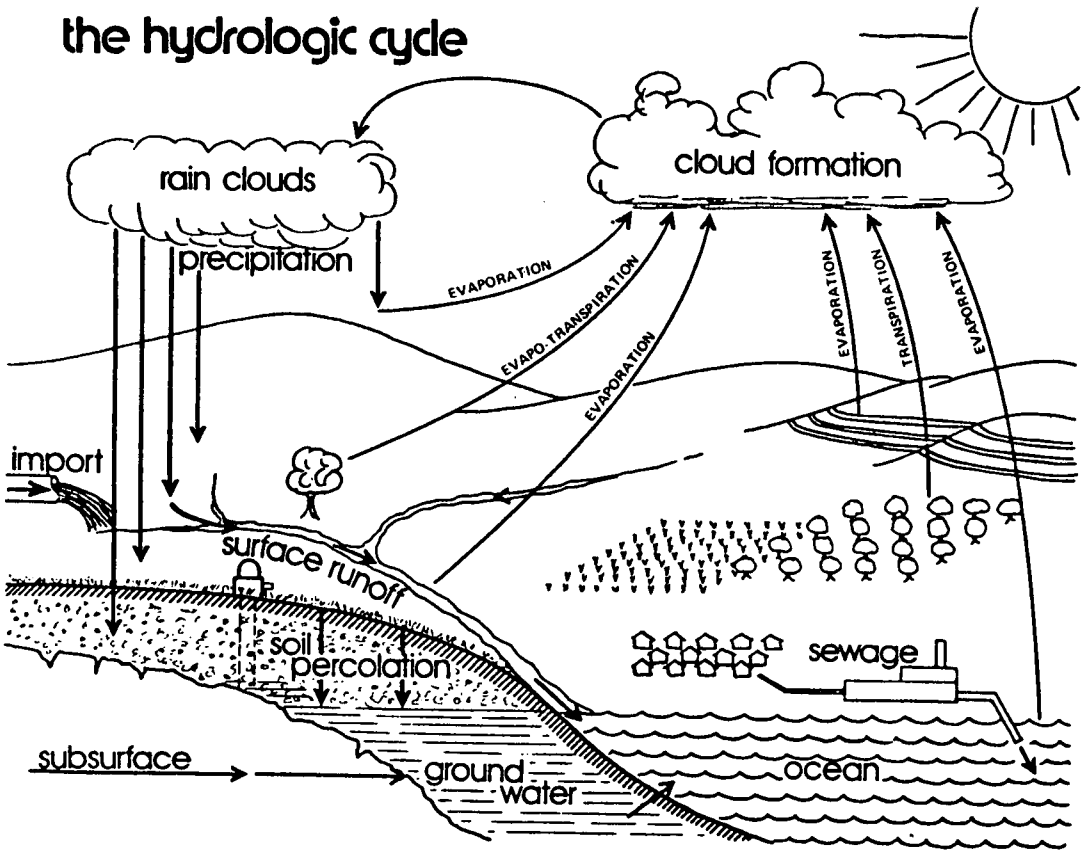
III. HYDROLOGIC BALANCE

Seasonal rainfall in Santa Clara Valley was above average in 1981-82. The San Jose Municipal Weather Station No. 86, which averages 14.2 inches (360 millimetres) per year, based on 108 years of record, recorded 22 inches (557 millimetres) which is 55 percent above normal. At Station No. 75 in Gilroy, which averages 19.3 inches (489 millimetres), 30 inches (767 millimetres) were recorded which is 57 percent above normal.

As of September 30, 1982, the amount of water in storage in all the reservoirs was 126 thousand acre-feet (155 million cubic metres) or 59 percent more than at the same date of the preceding year.

With rainfall in 1981-82 above average, the volume of groundwater in storage in the Santa Clara Valley, Coyote and Llagas Groundwater Subbasins increased. As water levels rise and fall, the volume in storage changes. This change of stored water in the unconfined zone can be estimated by multiplying estimates of the storage capacity for the aquifer materials by the area and by the change in depth between groundwater levels at the beginning and end of the season. This year, water in storage in the Santa Clara Valley Groundwater Subbasin increased by 83 thousand acre-feet (102 million cubic metres). In the Coyote Subbasin, the volume of water in storage increased by ten thousand acre-feet (12 million cubic metres) and in the Llagas Subbasin the volume of water in storage increased by 49 thousand acre-feet (60 million cubic metres).

These estimates were checked by balancing the hydrologic components of water supply and utilization. Water supply consists of precipitation, stream inflow, imported water, and subsurface inflow. Water is utilized or lost by consumptive use, sewage export, stream outflow, and subsurface outflow. The difference between supply and utilization is the net surplus or deficit of water in storage in the groundwater reservoirs at the end of the season. The hydrologic balance, illustrated in Figure 1, shows an increase in the Santa Clara Valley Subbasin of 83 thousand acre-feet (102 million cubic



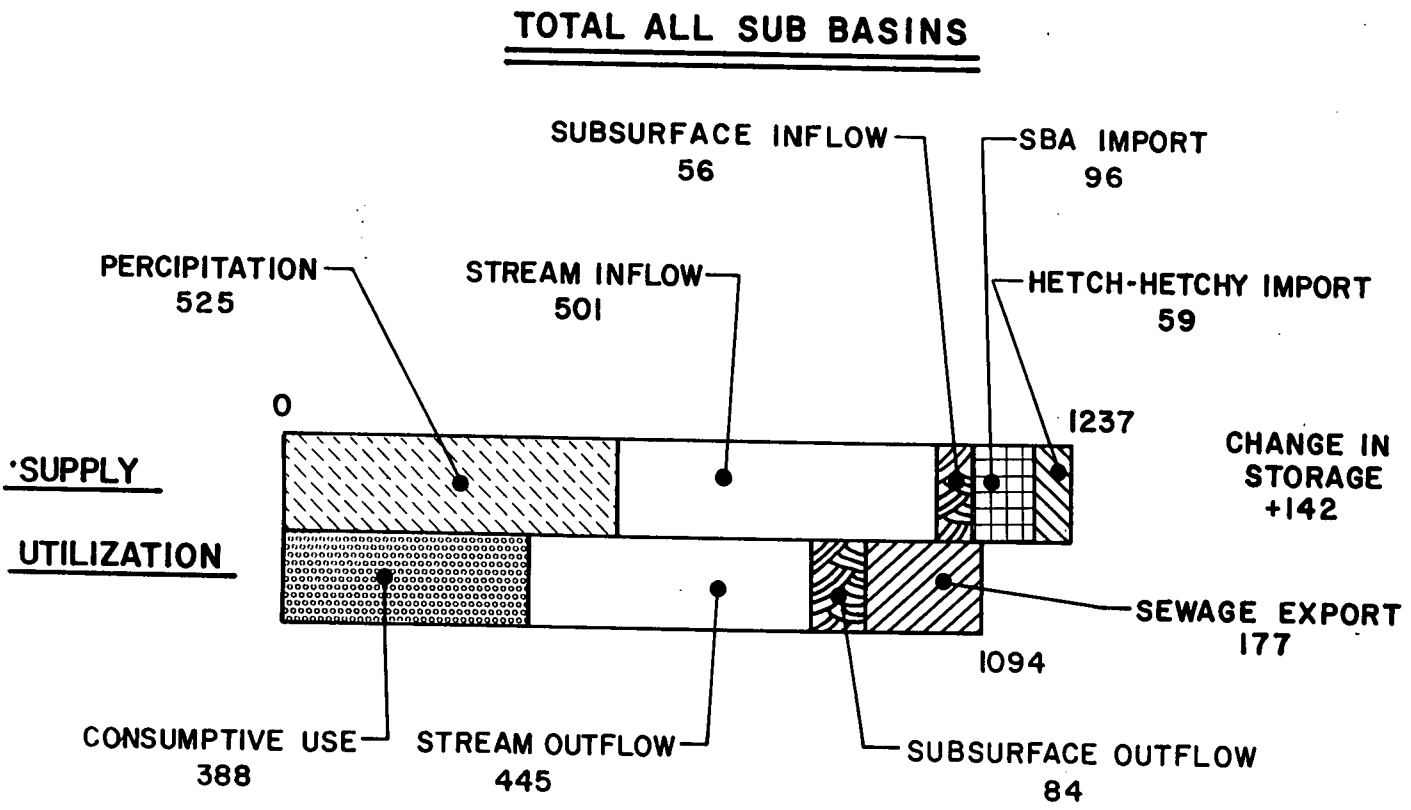
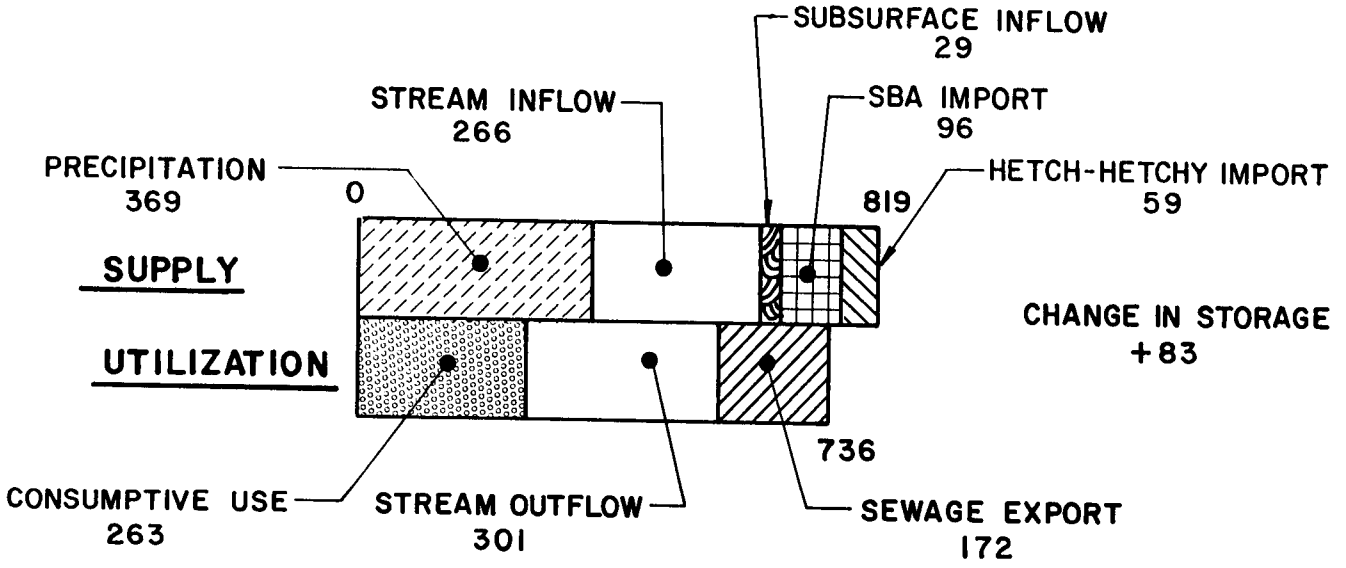


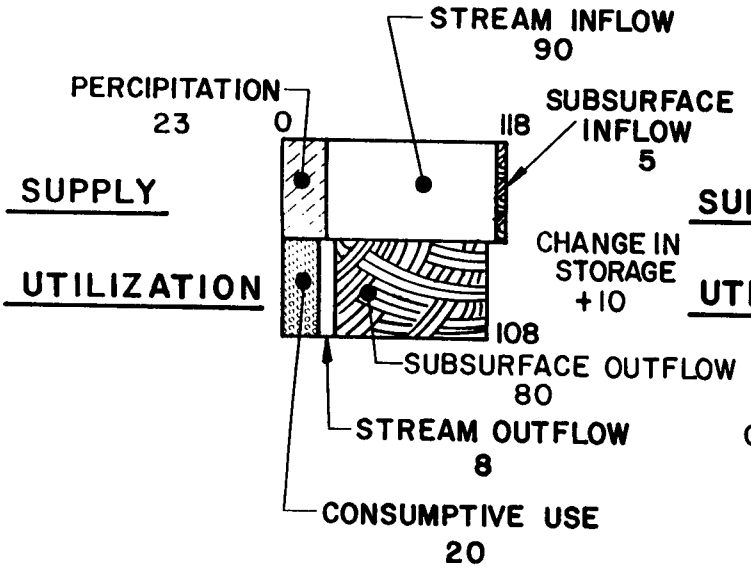
FIGURE 1-A HYDROLOGIC BALANCE OF GROUNDWATER 1981-82

Values in thousand acre feet
(One acre foot = 1233.5 cubic metres)

SANTA CLARA VALLEY G.W. SUB BASIN



COYOTE G.W. SUB BASIN



LLAGAS G.W. SUB BASIN

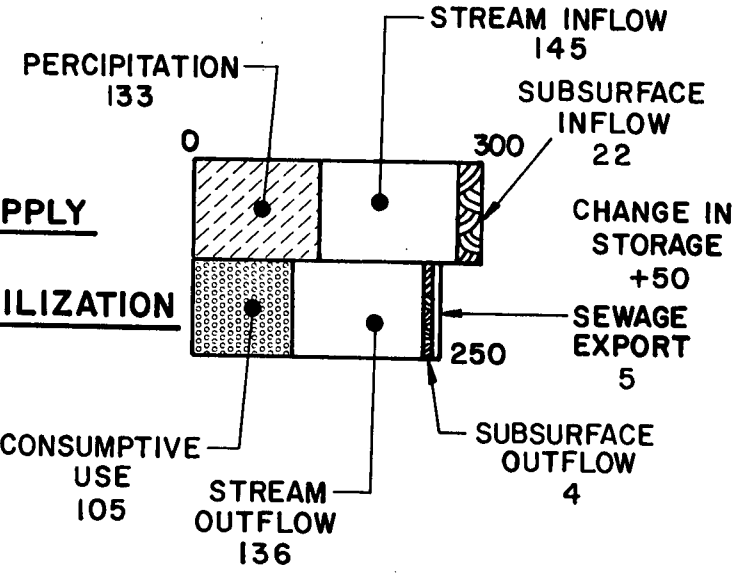


FIGURE 1-B HYDROLOGIC BALANCE OF GROUNDWATER 1981 - 82

Values in thousand acre feet

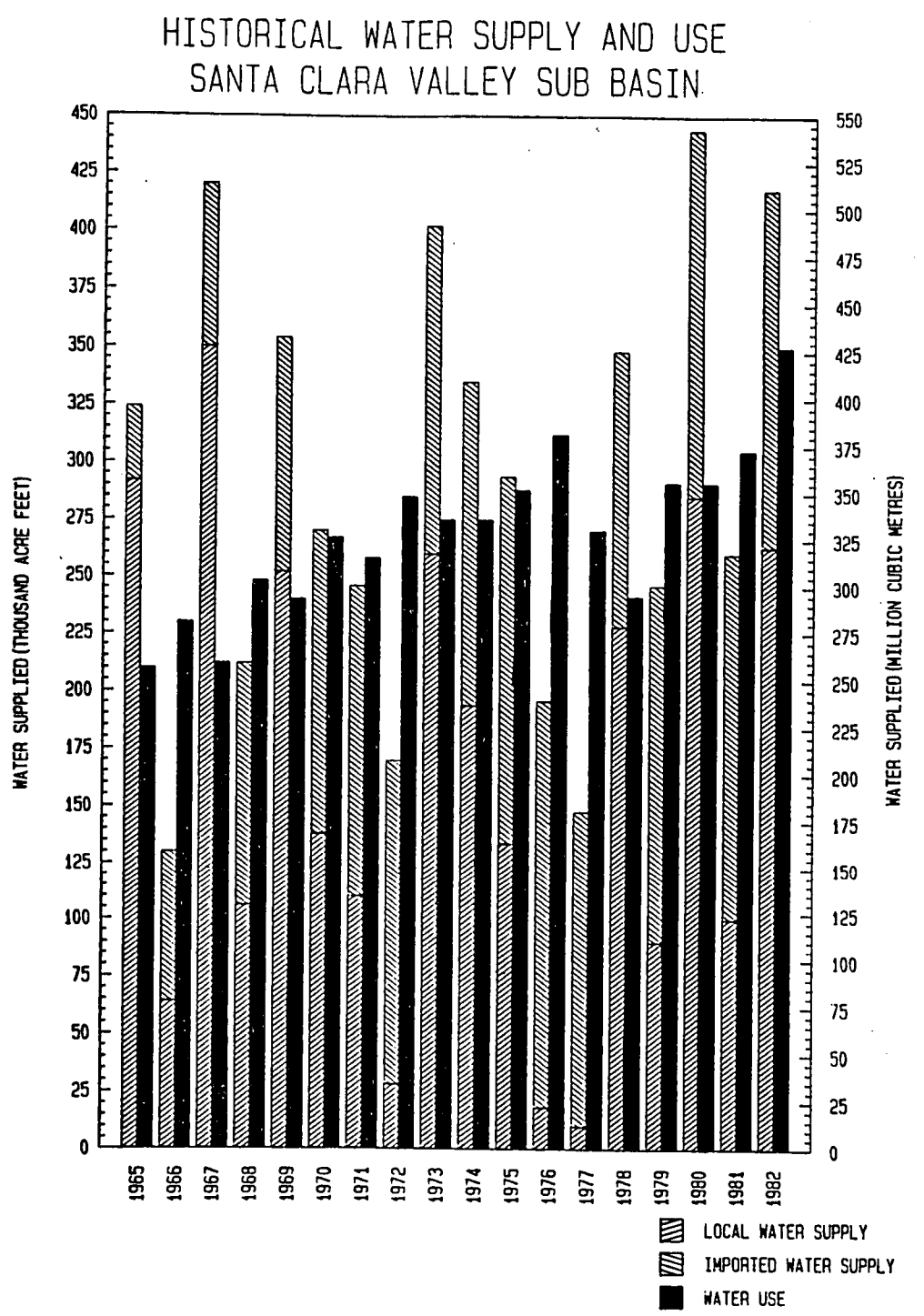
(One acre foot = 1233.5 cubic metres)

metres), the Coyote Subbasin an increase of nine thousand acre-feet (11.5 million cubic metres) and the Llagas Subbasin shows a decrease of 50 thousand acre-feet (61 million cubic metres). These compare very favorably to the previously obtained decrease of 83 thousand, ten thousand and 49 thousand acre-feet for the Santa Clara Valley, Coyote and Llagas Subbasins respectively calculated using changes in groundwater elevation.

Shown on Figure 2 is the historical total amount of water supply available from local and imported sources and the total amount of water use for the period 1965 through 1982 in the Santa Clara Valley Subbasin area, and rainfall data for the same period.

Local water sources include groundwater produced from the Santa Clara Valley Groundwater Subbasin and surface water deliveries including San Jose Water Company diversions. The groundwater production does not include the amount of SBA water used for groundwater recharge which was 50 thousand acre-feet (62 million cubic metres). The imported water deliveries consist of San Francisco Water Department water delivered through the Hetch-Hetchy Aqueduct, which began in Santa Clara County in 1952, and deliveries from the State Water Project through the South Bay Aqueduct which started in June 1965.

Actual water production in Santa Clara Valley Subbasin for the period 1970 through 1982 from all sources of supply is summarized in Table 1. Total supply and use for 1981-82 is illustrated in Figure 3.


HISTORICAL WATER SUPPLY AND USE
SANTA CLARA VALLEY SUB BASIN
WATER SUPPLIED (THOUSAND ACRE FEET)
WATER SUPPLIED (MILLION CUBIC METRES)
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
0
50
100
150
200
250
300
350
400
450
475
500
525
550
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
LOCAL WATER SUPPLY
IMPORTED WATER SUPPLY
WATER USE

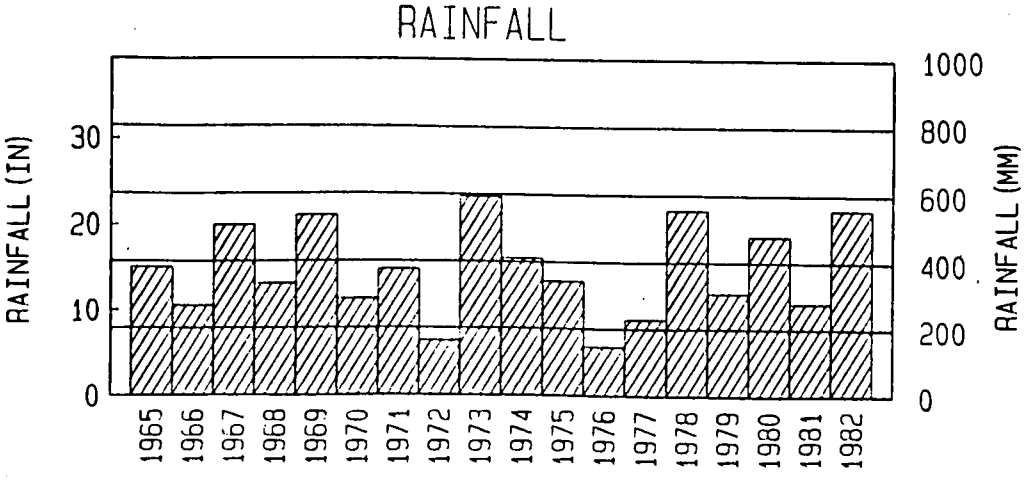

RAINFALL
RAINFALL (IN)
RAINFALL (MM)
0
10
20
30
0
200
400
600
800
1000
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982

FIGURE 2

TABLE 1

WATER USE SUMMARY

SANTA CLARA VALLEY GROUNDWATER SUBBASIN
(Values in thousand acre-feet)

Fiscal Year	Surface Water		Groundwater		Distribution of SBA Import*		Hetch Hetchy	SJWW Diversion	Total
	Ag	Non-Ag	AG	Non-Ag	Treated	Untreated			
64-65	5.6		37.9	119.6			29.5	13.0**	205.7
65-66	11.6		38.5	130.8			33.6	12.4**	226.9
66-67	3.4		28.9	127.6			35.8	12.8**	208.4
67-68	9.1		35.5	138.3	7.9		39.9	13.9**	244.5
68-69	8.3		28.5	135.1	11.2		41.7	12.9**	237.6
69-70	4.9	0.8	29.3	125.1	39.2	0.5	48.3	15.8	263.8
70-71	4.4	1.1	23.7	124.3	44.0	0.7	45.2	12.9	256.3
71-72	4.8	1.5	24.0	142.1	48.8	0.8	50.1	8.8	280.7
72-73	4.2	1.6	17.5	137.7	45.0	0.6	48.9	14.6	270.1
73-74	3.0	1.8	15.9	129.0	45.5	0.6	52.2	20.8	268.7
74-75	3.5	1.9	16.9	120.4	67.4	0.6	53.3	17.5	281.4
75-76	5.0	2.0	20.0	148.4	66.1	0.8	56.8	8.5	307.7
76-77	2.5	1.5	16.7	136.0	60.4	0.7	47.7	0.7	266.3
77-78	2.4	1.5	11.7	115.4	59.5	0.8	37.3	10.0	238.6
78-79	2.5	1.9	12.0	137.7	66.7	0.7	50.6	15.5	287.6
79-80	2.2	1.4	9.8	139.3	71.3	0.7	51.0	14.3	290.0
80-81	2.0	1.5	9.6	151.2	72.2	0.8	57.5	7.4	302.2
81-82	1.6	1.9	7.2	139.8	67.5	0.5	59.3	14.8	292.6

* Imported SBA Water recharged to the groundwater basin included in groundwater used (50 thousand acre-feet in 1981-82.

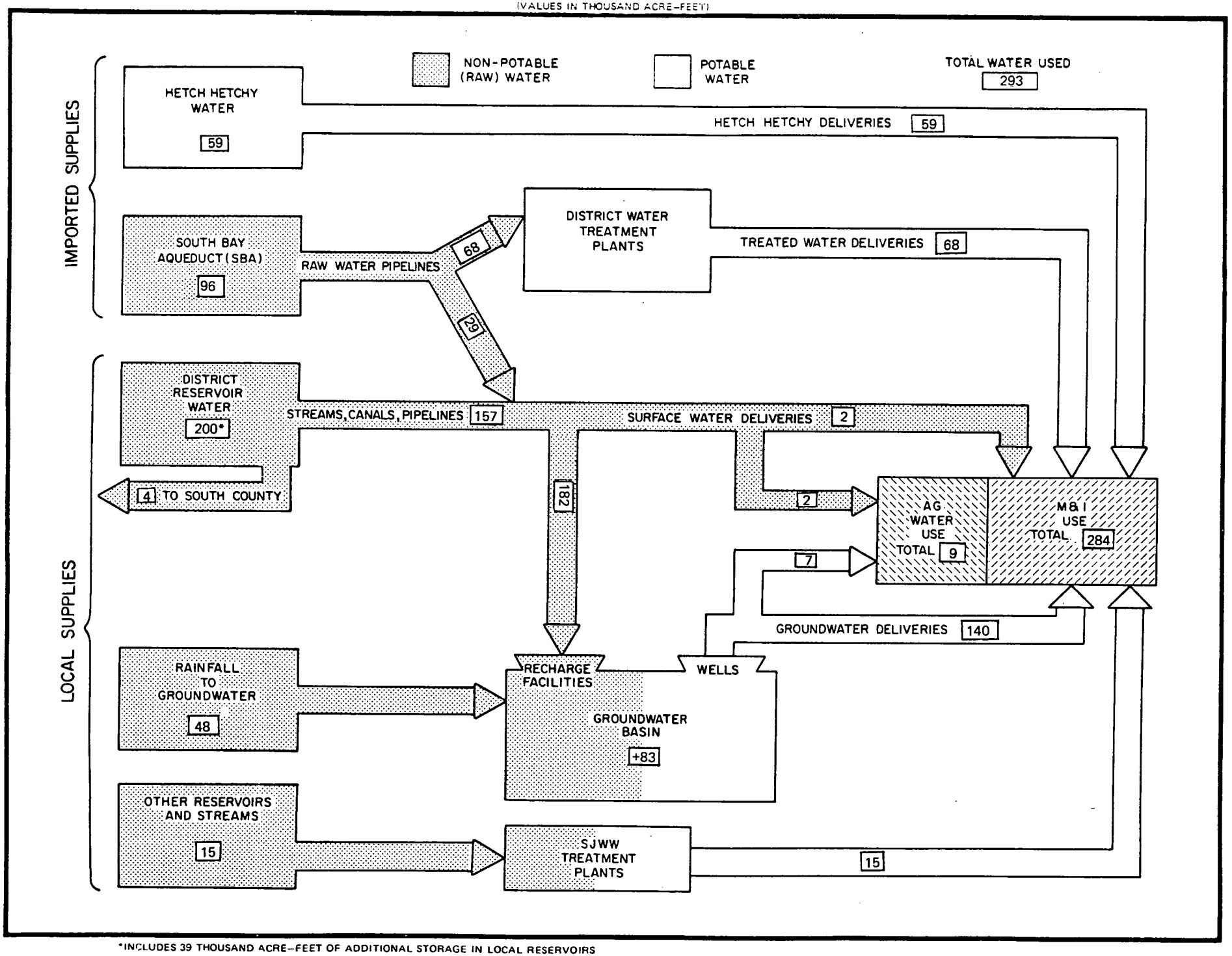
** Includes non-ag surface water deliveries

1981–82

WATER SUPPLY AND USE

Santa Clara Valley Groundwater Sub Basin

(VALUES IN THOUSAND ACRE-FEET)



*INCLUDES 39 THOUSAND ACRE-FEET OF ADDITIONAL STORAGE IN LOCAL RESERVOIRS

FIGURE 3

IV. WATER SUPPLY

A. Groundwater

Groundwater Levels

A groundwater contour map, showing lines of equal elevation of water levels in wells as of September 1, 1982 (traditionally the seasonal low) is shown on Plate 2. Plate 3 shows lines of equal change in elevation of water in wells between September 1981 and September 1982. Plate 4 shows lines of equal depth to water as of September 1, 1982. These groundwater contours are based on information from more than 350 wells.

The change in groundwater storage is obtained by use of Plate 3, Map of Equal Change in groundwater levels. Groundwater levels (determined from the unconfined area of the groundwater contour map) for the Santa Clara Valley Subbasin show an increase of 15 feet (4.6 metres) from 1981 levels, the Coyote Subbasin show a decrease of 17 feet (5.2 metres) and the Llagas Subbasin a decrease of 27.6 feet (8.4 metres).

An index of the monthly fluctuation of water levels from 1963 to 1982 in the Santa Clara Valley, Coyote, and Llagas Subbasins is presented in Figure 4. Well Nos. 07S01E07R99 and 10S03E13D03 are the well hydrographs used to represent trends in the Santa Clara Valley and Llagas Groundwater Subbasins, respectively. The Coyote Subbasin is represented on Figure 4 by the weighted average depths to water in four representative wells, which are monitored at the beginning of each month. These weighted averages are indexes and as such do not represent the actual depth to water at any point within this basin. The intent of Figure 4 is to show trends in the change of groundwater levels in the subbasins over the years.

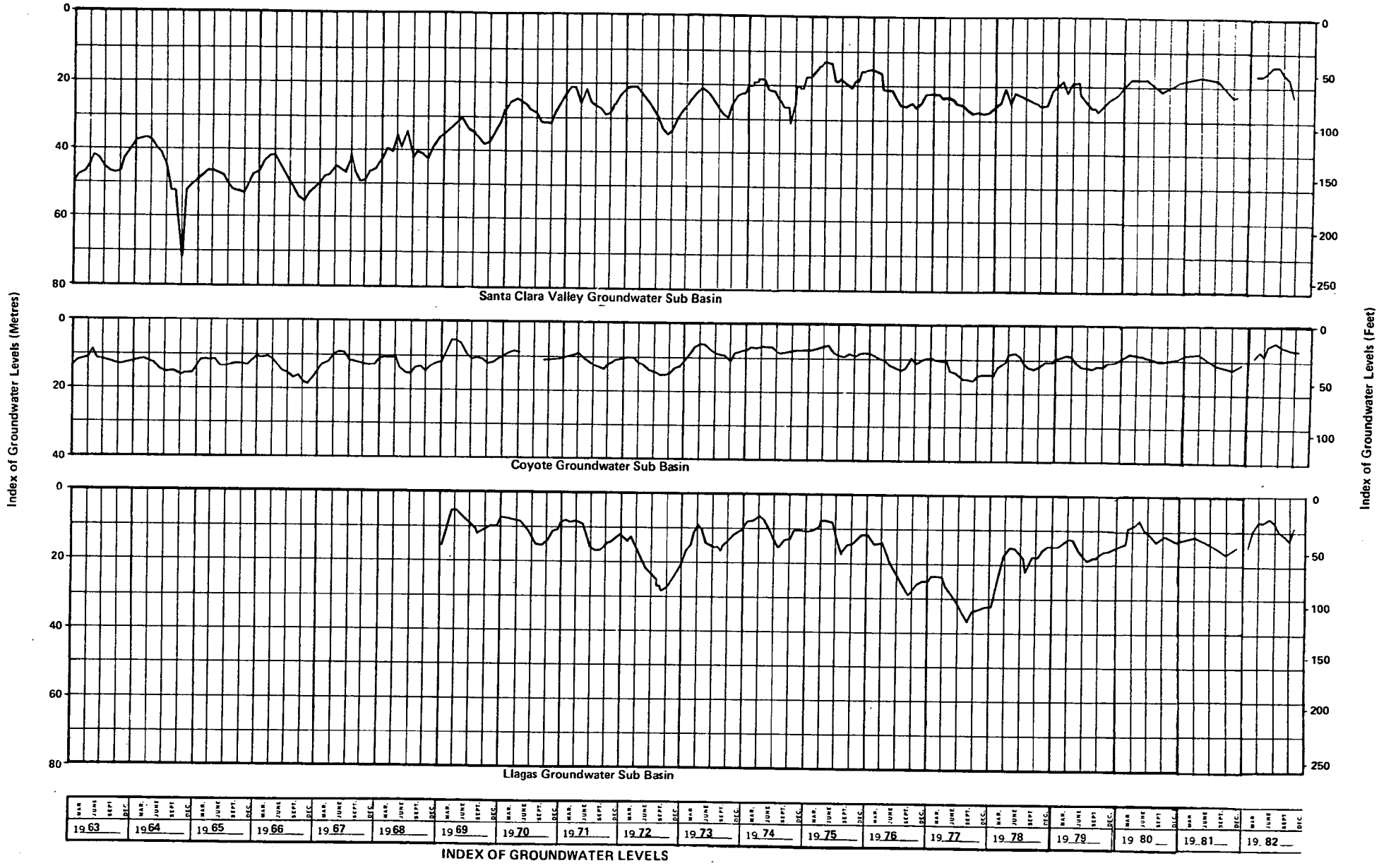

Index of Groundwater Levels (Metres)
Index of Groundwater Levels (Feet)
0
20
40
60
80
0
50
100
150
200
250
Santa Clara Valley Groundwater Sub Basin
Coyote Groundwater Sub Basin
Llagas Groundwater Sub Basin
MAR. JUNE SEPT. DEC.
19 63
19 64
19 65
19 66
19 67
19 68
19 69
19 70
19 71
19 72
19 73
19 74
19 75
19 76
19 77
19 78
19 79
19 80
19 81
19 82
INDEX OF GROUNDWATER LEVELS

Figure 4

Groundwater Recharge

The District, as part of its ongoing water management program, recharges the Santa Clara Valley, Coyote, and Llagas Groundwater Subbasins with local and imported water.

In 1981-82, which was a very wet year, a total of 230 thousand acre-feet (285 million cubic metres) of water were recharged in the Santa Clara Valley Subbasin. About 153 thousand acre-feet (189 million cubic metres) of water were recharged from reservoir supplies and about 29 thousand acre-feet (36 million cubic metres) were recharged from imported South Bay Aqueduct water. About 48 thousand acre-feet (60 million cubic metres) were estimated to have reached the groundwater from rainfall. Additionally, four thousand acre-feet (five million cubic metres) of water were recharged in the Coyote and Llagas Subbasins from Anderson Reservoir through the Main Avenue and Madrone Channel Recharge Facilities.

Land Surface Subsidence

Subsidence of the land surface occurs when intensive groundwater pumping results in lowered water pressures in the groundwater basin materials. This increases the effective overburden load on the clay materials in and separating the aquifers. As a result, the clay materials compact with consequential sinking of the overlying land surface. The District established a single level circuit around the south end of San Francisco Bay that was run annually from 1963 to 1976. This line of levels has not been run since 1976 because the amount of land surface subsidence was less than the accuracy of the leveling.

In 1960, the U.S. Geological Survey installed extensometers (compaction recorders) in 1,000 feet (305 metre) cased holes at the centers of subsidence, one in San Jose and another in Sunnyvale. These extensometers have recorded compaction of the confined aquifer system for over 20 years.

Records from these instruments show that the compaction measured to a depth of 305 metres is about equal to the land surface subsidence as measured periodically by leveling of the bench marks.

According to Poland, "The subsidence in the Santa Clara Valley of California has been stopped by raising the artesian head in the aquifers until it equaled or exceeded the maximum pore pressures in the aquitards. The compaction and water-level records being obtained by the Geological Survey indicate that if the artesian head can be maintained 10 to 20 feet above the levels of 1971-73, subsidence will not recur. On the other hand, subsidence will recommence if the artesian head is drawn down as much as 20 to 30 feet below the 1971-73, levels."[1/]

B. Precipitation

Rainfall is the source of all locally developed water supplies. The long-term precipitation at San Jose is illustrated in Figure 5 as the accumulated departure from the mean which denotes graphically the wet and dry periods of rainfall. The important feature in Figure 5 is the slope of the line; particularly whether it is positive (up) or negative (down). Each point is plotted as a difference from the long-term average; a wet year showing a positive difference and a dry or below normal rainfall year indicating a negative difference. If each difference is added to that of the previous year, a trend of positive or negative increments becomes apparent. An upward trend would, therefore, indicate a period of years which have received above normal rainfall and a downward trend would be indicative of a below normal period.

The accumulated departure from the mean is used to identify long-term wet and dry periods. Despite short term fluctuations, the long-term periods are easily discernible.

1/ Poland, Joseph F., "Land Subsidence in Santa Clara Valley, California", Water Spectrum, Department of the Army, Spring 1978, Vol. 10, No. 2.

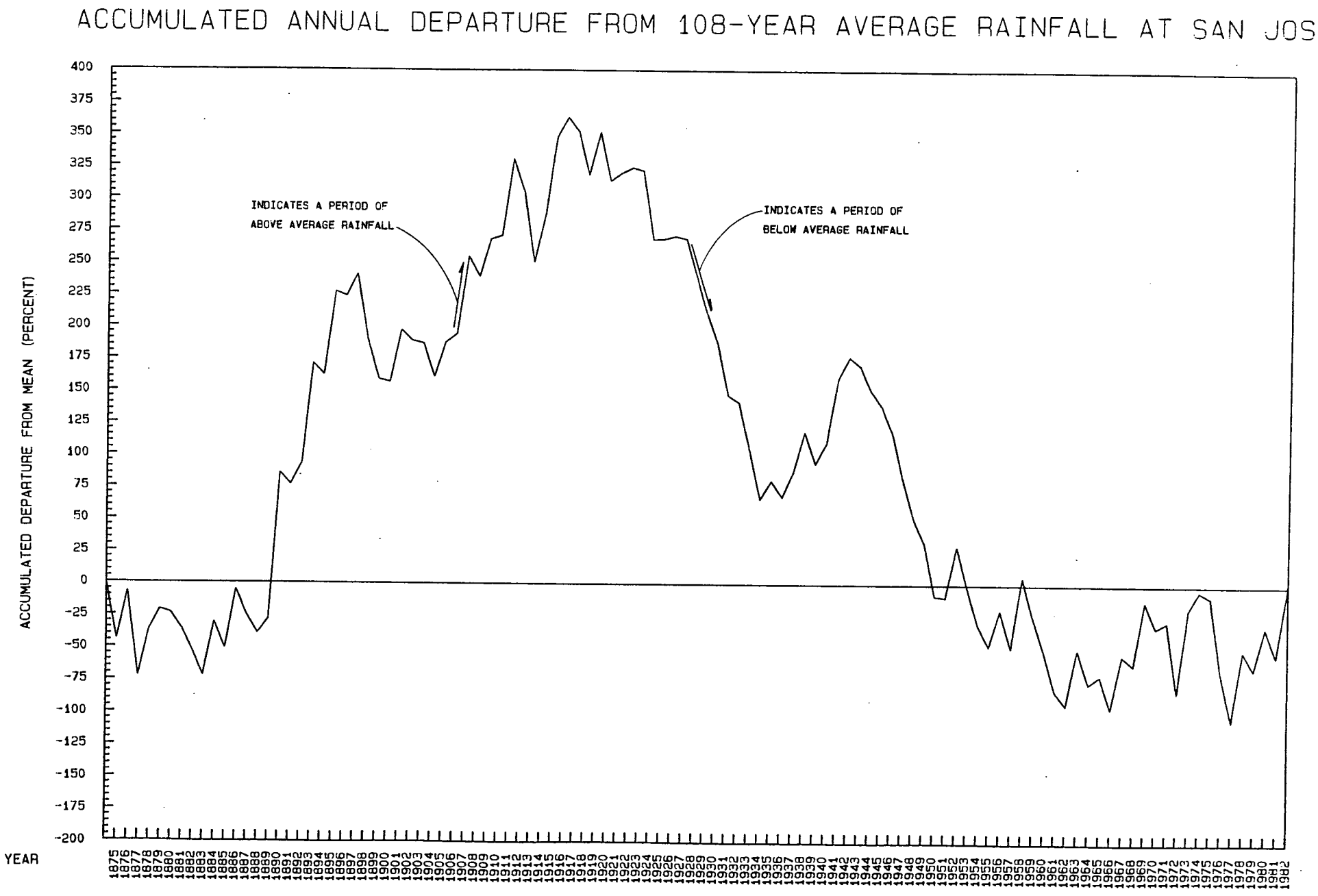

ACCUMULATED ANNUAL DEPARTURE FROM 108-YEAR AVERAGE RAINFALL AT SAN JOSE
INDICATES A PERIOD OF ABOVE AVERAGE RAINFALL
INDICATES A PERIOD OF BELOW AVERAGE RAINFALL
ACCUMULATED DEPARTURE FROM MEAN (PERCENT)
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
-25
-50
-75
-100
-125
-150
-175
-200
YEAR
1875 1876 1877 1878 1879 1880 1881 1882 1883 1884 1885 1886 1887 1888 1889 1890 1891 1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

Figure 5

Beginning in 1875, rainfall approximated the long-term average until 1890 when a series of wet years began which generally continued until about 1916. The valley experienced low rainfall for several years following 1920 until 1935. It was during this drought period that valley residents first initiated a comprehensive water conservation program. The completion of the valley's first five water supply reservoirs in 1935 coincided with the beginning of a short interval of above-average rainfall. This enhanced the water supply picture and enabled groundwater levels, which had been declining, to recover.

Between 1943 and 1962, another series of dry years occurred. From 1962 to 1975, the valley rainfall was slightly above the long-term average. From 1975 to 1981, except for 1977-78 and 1979-80, rainfall was below average. In 1982 rainfall was about 55 percent above average.

Weather Modification

In its search for additional means of increasing its water supply, the District has been conducting cloudseeding operations since December of 1951.

Under natural conditions only a small amount of the moisture passing over the valley in the form of clouds ever reaches the ground as rain or snow. The function of a cloudseeding program is to increase total precipitation by introducing artificial nuclei into the clouds at the proper time and location.

The basic conditions for successful operation of the District's weather modification program occur when moisture-laden air masses from the Pacific Ocean are driven over the Santa Cruz Mountains by the westerly and southwesterly winds that prevail during storms. As these air masses approach the mountains, they are forced to rise abruptly, producing turbulence and rapid vertical velocities. When cloud droplets rapidly rise to altitudes above the freezing level, they form into ice crystals on dust, hydrocarbon particles, and other substances. When these ice crystals fall to an elevation where the temperature is above the freezing point, they melt, thereby forming raindrops which continue to collect moisture and grow larger as they fall to earth.

Minute crystals of silver iodide (AgI) also act as nucleating agents and are effective at higher temperatures than natural nuclei. One gram of silver iodide produces millions of nuclei.

Ground-based generators located to the west and south of the main watersheds are used to produce the nuclei which are carried aloft by the rising air currents passing over the mountains.

Cloudseeding is a rain-increasing and not a rain-making process. During dry years, few, if any, opportunities exist for seeding. The increase in seasonal rainfall has been indicated to range between 10 percent and 15 percent for those years when cloudseeding was conducted.

Due to the above average rainfall, there was no cloudseeding during the 1981-82 season.

C. Imported Water

The existing and proposed water import conveyance, treatment and distribution system for Santa Clara Valley is shown in Figure 6.

South Bay Aqueduct

The primary source of imported water for Santa Clara County is the South Bay Aqueduct. In 1981-82, 96 thousand acre-feet (119 million cubic metres) of water was delivered into Santa Clara County through this facility. Of this total, 45 thousand acre-feet (55 million cubic metres) was treated at the Rinconada Water Treatment Plant and 23 thousand acre-feet (28 million cubic metres) was treated at the Penitencia Water Treatment Plant for delivery to consumers through retail water agencies. In addition, 660 acre-feet (0.8 million cubic metres) of raw water was delivered directly from District pipelines for use by individual contractors. The remaining 29 thousand acre-feet (36 million cubic metres) was recharged into the underground water supply through the District's recharge facilities.

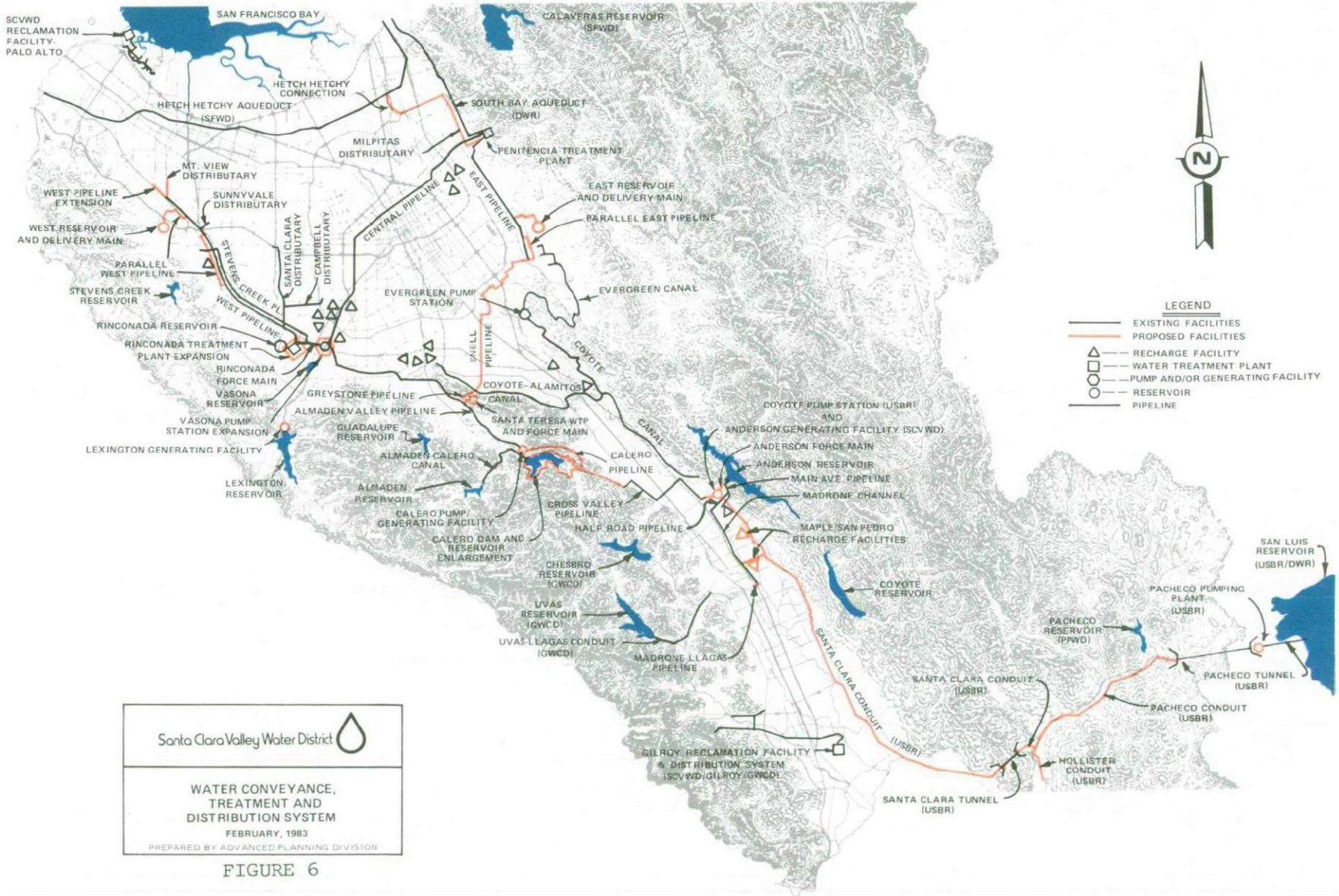

SCVWD RECLAMATION FACILITY PALO ALTO
SAN FRANCISCO BAY
HETCH HETCHY CONNECTION
HETCH HETCHY AQUEDUCT (SFWD)
CALAVERAS RESERVOIR (SFWD)
SOUTH BAY AQUEDUCT (DWR)
MILPITAS DISTRIBUTARY
PENITENCIA TREATMENT PLANT
MT. VIEW DISTRIBUTARY
WEST PIPELINE EXTENSION
SUNNYVALE DISTRIBUTARY
WEST RESERVOIR AND DELIVERY MAIN
CENTRAL PIPELINE
EAST PIPELINE
EAST RESERVOIR AND DELIVERY MAIN
PARALLEL EAST PIPELINE
PARALLEL WEST PIPELINE
STEVENS CREEK RESERVOIR
STEVENS CREEK PL
WEST PIPELINE
SANTA CLARA DISTRIBUTARY
CAMPBELL DISTRIBUTARY
EVERGREEN PUMP STATION
EVERGREEN CANAL
RINCONADA RESERVOIR
RINCONADA TREATMENT PLANT EXPANSION
RINCONADA FORCE MAIN
VASONA RESERVOIR
SNELL PIPELINE
COYOTE CANAL
GREYSTONE PIPELINE
COYOTE-ALAMITOS CANAL
ALMADEN VALLEY PIPELINE
VASONA PUMP STATION EXPANSION
SANTA TERESA WTP AND FORCE MAIN
GUADALUPE RESERVOIR
LEXINGTON GENERATING FACILITY
ALMADEN CALERO CANAL
CALERO PIPELINE
LEXINGTON RESERVOIR
ALMADEN RESERVOIR
CROSS VALLEY PIPELINE
CALERO PUMP/GENERATING FACILITY
HALF ROAD PIPELINE
CALERO DAM AND RESERVOIR ENLARGEMENT
CHESBRO RESERVOIR (GWCD)
UVAS RESERVOIR (GWCD)
UVAS LLAGAS CONDUIT (GWCD)
MADRONE LLAGAS PIPELINE
COYOTE PUMP STATION (USBR) AND ANDERSON GENERATING FACILITY (SCVWD)
ANDERSON FORCE MAIN
ANDERSON RESERVOIR
MAIN AVE PIPELINE
MADRONE CHANNEL
MAPLE/SAN PEDRO RECHARGE FACILITIES
COYOTE RESERVOIR
SAN LUIS RESERVOIR (USBR/DWR)
PACHECO PUMPING PLANT (USBR)
PACHECO RESERVOIR (PPWD)
PACHECO TUNNEL (USBR)
PACHECO CONDUIT (USBR)
SANTA CLARA CONDUIT (USBR)
SANTA CLARA CONDUIT (USBR)
HOLLISTER CONDUIT (USBR)
SANTA CLARA TUNNEL (USBR)
GILROY RECLAMATION FACILITY & DISTRIBUTION SYSTEM (SCVWD/GILROY/GWCD)
N
LEGEND
EXISTING FACILITIES
PROPOSED FACILITIES
RECHARGE FACILITY
WATER TREATMENT PLANT
PUMP AND/OR GENERATING FACILITY
RESERVOIR
PIPELINE
Santa Clara Valley Water District
WATER CONVEYANCE, TREATMENT AND DISTRIBUTION SYSTEM
FEBRUARY, 1983
PREPARED BY ADVANCED PLANNING DIVISION

FIGURE 6

Hetch Hetchy

San Francisco Water Department's Hetch Hetchy Aqueduct provides a second source of imported water. During the fiscal year 1981-82, this system delivered 59 thousand acre-feet (73 million cubic metres) directly to the water supply systems of the Cities of Milpitas, San Jose, Sunnyvale, Santa Clara, Mountain View, and Palo Alto and to the Purissima Hills County Water District. Small amounts 4,890 acre-feet (six million cubic meters) of this water were also delivered to Stanford University, Moffett Field and Agnews State Hospital.

San Felipe Project Status

A progress report on the San Felipe Division of Federal Central Valley Project dated May 1982, showed that construction of the Pacheco Tunnel lining was 95 percent completed. A contract for the pumps and motors for the Pacheco Pumping Plant had been also awarded. Drilling of the Santa Clara Tunnel had been completed. Additional construction contract bids for the northern ten miles of the Santa Clara Conduit were scheduled for August 1982 and for the Pacheco Pumping Station structure for September 1982.

Concurrent with the work of the Bureau of Reclamation, construction of the District's Distribution System continued. As of the end of Fiscal Year 1981-82, Phase I, Unit II of Almaden Valley Pipeline was near completion. Unit I of the Cross Valley Pipeline, which will transport water from Coyote Pumping Station (USBR facility) to Calero Reservoir, had been completed. Contracts for the construction of Unit II of the Cross Valley Pipeline had been awarded. Units III and IV will follow with operation of all units scheduled for 1985.

D. Water Conservation

The term "Water Conservation", as used in this report, refers to programs to manage and make the best use of water available to the District from all sources. "Water Savings" refers to efforts to reduce water use, a part of any water conservation program, and is discussed later in this section of this report.

The District's water conservation program, an integral part of its overall water management activities, includes local water storage facilities, wastewater reclamation, and water savings programs.

Local Storage Reservoirs

The District has constructed storage reservoirs on most of the major streams to retain seasonal runoff which later is released for groundwater recharge and direct surface irrigation. The District owns and operates eight dams and reservoirs with a combined capacity of about 155,000 acre-feet (190 million cubic metres). Other public agencies in the County have constructed additional reservoirs with a total storage capacity of about 24,000 acre-feet (30 million cubic metres). Another significant storage reservoir is San Jose Water Works' Lake Elsman with a capacity of about 7,500 acre-feet (nine million cubic metres).

Table 2 shows the capacity and percent full of all the reservoirs on September 30, 1981 and on October 1, 1982. On October 1, 1982, the total amount of water stored in all these reservoirs was 126 thousand acre-feet (155 million cubic metres) which is 47 thousand acre-feet (58 million cubic metres) more than on September 30, 1981. Of these 47 thousand acre-feet (58 million cubic metres), eight thousand acre-feet (ten million cubic metres) correspond to the increase in storage in Gavilan Water Conservation District reservoirs.

Water Reclamation

In its search for new sources of water, the District, as early as 1958, engaged a private consultant to explore methods of reclamation of sewage and industrial wastewater. An oxidation pond was constructed adjacent to the San Jose Water Pollution Control Plant. Tests were conducted over a two-year period yielding valuable information for future efforts.

Presently, two water reclamation plants are in operation.

TABLE 2

RESERVOIR STORAGE

Reservoir	Capacity		Percent Full	
	Acre-Feet	Million Cubic Metres	Sept. 30, 1981	Oct. 1, 1982
Almaden	1,800	2.2	40.8	70.6
Anderson	91,300	112.6	60.7	78.7
Calero	10,200	12.5	13.0	0
Chesbro*	8,100	10.0	16.2	69.6
Coyote	23,700	29.2	6.4	92.8
Guadalupe	3,700	4.6	10.1	77.3
Lexington	20,200	24.9	7.3	64.5
Pacheco**	6,100	7.6	0.04	36.1
Stevens Creek	3,600	4.4	0.02	19.2
Uvas*	10,000	12.3	22.5	56.6
Vasona	400	0.5	90.6	80.0

* Gavilan Water Conservation District's Reservoirs

** Owned by Pacheco Pass Water District

Water Reclamation Facility, Palo Alto

Operation of the Palo Alto Reclamation Facility began in June 1977. This facility can produce high-quality water at a rate of four million gallons daily by providing advanced wastewater treatment to effluent from the adjacent Palo Alto Regional Water Quality Control Plant. During 1981-82, a limited amount of reclaimed water from the Palo Alto Reclamation Facility was sold.

Water Reclamation Facility, Gilroy

The wastewater reclamation facility in Gilroy was constructed under an emergency program to combat the severe overdraft of a limited underground reservoir and meet the need for new water supplies in the Gilroy area during the drought of 1976-77.

The facility was constructed jointly by the Santa Clara Valley Water District, the City of Gilroy, and the Gavilan Water Conservation District.

The treatment system takes primary effluent from the City of Gilroy domestic sewage treatment plant and provides secondary treatment in an oxidation pond.

The recycled water is used for agriculture and landscape irrigation. During 1981-82, the amount of reclaimed water sold was 193 acre-feet (238 thousand cubic metres).

Water Reclamation Study, Santa Clara Valley

The purpose of this study is to determine the feasibility of reclaiming wastewater to augment water supplies in Santa Clara County. This study is being conducted jointly by the Santa Clara Valley Water District and the Department of Water Resources. The study has investigated the possibility of surface delivery of reclaimed water for irrigation and agricultural lands in South County (Phase IA) and is currently investigating the feasibility of distributing reclaimed water by recharging it into the groundwater basins (Phase IB). The report of Phase IA of the study was completed in December 1980. That report concluded that direct delivery of reclaimed water for irrigation of agriculture is not financially feasible without large subsidies. A report on the findings of the Phase IB study will be completed in 1983.

Water Savings Program

Water savings is and always has been an integral part of the District's overall water supply program. During the 1977 drought, the District established an emergency goal of a 25 percent reduction in water use. This goal was later reduced to maintain a water savings of at least ten percent on the basis of pre-drought levels of use in order to

ensure a balanced water supply for the future. All recent studies of future demand and required supplies have included the effects of such a reduction.

In mid-1980, the Department of Water Resources, Office of Water Conservation, the SCVWD and the City of San Jose, undertook a campaign to reduce consumption of water and to reduce flows to the sewage treatment plant. The water savings program consisted of distributing and promoting installation of water conservation kit devices to 475,000 households in Santa Clara County. Savings from this program are estimated to be four thousand acre-feet (5 million cubic metres) per year.

V. WATER QUALITY

A. Streams

The stream surface water quality monitoring program in 1980-81 consisted of sampling 11 stream stations. These sampling stations were located at streamflow stations and were sampled during the report period for specific conductance, pH, temperature, DO, hardnesses, Ca, Mg, Na, SAR, sodium percent, K, alkalinity, SO_4, Cl, F, SiO_2, solids, total, dissolved Nitrogen (NO_2, NO_3, NH_3 and organic) total phosphorus, dissolved metals (Al, B, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn), and TOC.

Except for the metals and TOC, which were measured twice, all parameters were measured eight times during the report period. The stream sampling stations are located at the following stream flow stations:

Los Gatos Creek

Station 67	-	below Lexington Reservoir
Station 59	-	at Lark Avenue
Station 50	-	at Lincoln Avenue

Guadalupe Creek

Station 43	-	at Los Gatos Golf Course
Station 20	-	at Alamitos Recharge System
Station 16900	-	downtown San Jose

Coyote Creek

Station 9	-	below Anderson Reservoir
Station 58	-	at Edenvale

Llagas Creek

Station 69	-	below Chesbro Reservoir
Station 11158555	-	25 feet upstream of Machado School
Station 11153530	-	at San Martin Avenue

The data collected will be used to identify long term variations in quality and evaluate the effects of change in land use and other activities on the quality of water in streams in Santa Clara County. A report containing all the data collected and its evaluation will be completed in 1983.

B. Reservoirs

In 1974 the District began conducting limnologic investigations of the conservation reservoirs. Limnology is the study of physical, chemical, and biological conditions of a freshwater body, and its tributary streams and watershed. During 1981-82 the limnologic program consisted of 1) continued monitoring of Anderson Reservoir, 2) completion of limnologic investigation of Lexington Reservoir and 3) continuation of an investigation at Calero Reservoir which will be completed in 1983.

The product of these investigations is a collection of adequate base-line water quality data for each reservoir. Evaluation of the information collected during regular monitoring and observation of water quality trends aids in the identification of sources of contamination, will aid in predicting the impact of projected land use changes in the watersheds and will be a valuable tool in the selection of reservoir operation criteria.

C. Groundwater Quality

To aid in the management and protection of the quality of all the waters in the valley, the District monitors the quality of waters in the underground subbasins, streams, and the surface reservoirs. As of the end of fiscal year 1981-82, about thirty leaks of hazardous chemicals, mostly from underground storage tanks, had been identified in Santa Clara County, some of which have already seriously affected the groundwater quality. These leaks are located mostly in Sunnyvale, San Jose, Santa Clara, Palo Alto and Mountain View. However, work being done by the San Francisco Bay Regional Water Quality Control Board is expected to uncover more previously unidentified leaks of hazardous materials into the groundwater.

The prevention of further groundwater contamination is being addressed in the "Model Hazardous Materials Storage Permit Ordinance" being developed by the Intergovernmental Council of Santa Clara County. This Ordinance, which will be submitted to all the cities for adoption, provides for procedures to safely store hazardous materials as well as to monitor the areas immediately surrounding storage facilities.

Santa Clara Valley Water District has adopted well construction and destruction standards (SCVWD Ordinance No. 75-6), which will be modified to address groundwater contamination by industry.

Localized areas have yielded groundwater of poor quality as a result of contamination from surface waters or degradation from subsurface sources. In the summer of 1979 the Department of Water Resources confirmed the high levels of nitrates in the San Martin area, earlier found by the Central Coast Regional Water Quality Control Board. A special water quality study to identify sources of the nitrate in the San Martin area was completed by a consultant under the direction of Santa Clara County Planning Department. This study concluded that the quality of the water in this area is generally good except for the high nitrate content. The principal sources of nitrates entering the Llagas groundwater subbasin in San Martin were found to be effluent from individual waste treatment and disposal systems and nitrate from fertilizers carried by irrigation water that percolates through the soil.

Another area of groundwater degradation is in the Santa Cruz Mountains above Lexington Reservoir where the Santa Clara County Health Department has obtained samples of water from domestic wells that do not meet drinking water standards. Information gathered from the surveys conducted showed that the source of groundwater contamination were on-site treatment and disposal wastewater systems which were not maintained or were designed with insufficient capacity for the present loading. In addition, many original septic tanks have deteriorated and collapsed and leach field pipes have been crushed. Several alternative solutions are being studied by the Santa Clara County Board of Supervisors.

Another groundwater quality concern is saltwater intrusion into fresh aquifers. Saltwater intrusion has occurred in aquifers along the baylands area bordering south San Francisco Bay in Santa Clara County. Recognizing the problem, SCVWD conducted a study to assess existing conditions and to evaluate possible actions that were required to

prevent or minimize further intrusion. The study concluded that presently, saltwater is mostly contained within the upper aquifer (above 150 feet (50 metres) in depth, however, some areas of the main aquifer (below 150 feet) also contain saltwater. Saltwater is most likely finding its way through defective or improperly sealed or abandoned wells. Based upon these findings, SCVWD staff designed a project to alleviate this situation, which has been approved for grant funding under the State Clean Water Assistance Program. The project is expected to take three years to complete and will cost about $350,000 of which about $238,000 will be grant funded.

The project objective is to locate and have sealed or repaired old wells which were not properly constructed or maintained or have been abandoned or destroyed and are probably providing conduits for interaquifer transfer of saltwater. This will prevent or substantially reduce the possibility of further degradation of the lower aquifer.

VI. GLOSSARY*

Acre-Foot - A measurement of volume of water equaling 43,560 cubic feet or 325,851 gallons, an amount that would cover an area of an acre, one foot deep (a football field would be covered one and a quarter feet deep).

Aquifer - A geologic formation that stores, transmits, and yields significant quantities of water to wells and springs.

Aquitard - A geologic formation which, although porous and may store large quantities of water, will not transmit water fast enough to yield an appreciable supply for a well.

Artesian Well - A well in which water is lifted by hydrostatic pressure above the land surface at the well.

Biochemical Oxygen Demand (BOD) - The quantity of oxygen consumed in biological processes that decompose organic matter in water.

Confined Aquifer - An aquifer overlain by material sufficiently impervious to retain groundwater in the aquifer under pressure.

Connate Water - Water which was entrapped in a geologic formation at the time the formation was deposited. If the formation was deposited in the ocean or a saline lake, the connate water is also saline.

Consumptive Use - Water consumed by vegetative growth in transpiration and building of plant tissue, and water evaporated from adjacent soil, from water surfaces, and from foliage. Also, water similarly consumed and evaporated by urban and nonvegetative types of land use.

Contamination - An impairment of the quality of water by micro-organisms, chemicals, sewage, or industrial waste which renders the water unfit for its intended use. In California, this means the water constitutes an actual hazard to public health (see also Pollution).

Cubic Feet Per Second (CFS) - A unit of measurement of flowing water; the number of cubic feet of water which passes a given point in a second.

Dissolved Oxygen (D.O.) - The oxygen dissolved in water. It is essential for aquatic life.

Dry Period - An historic period of years when water supply is much below normal. An example was 1929-34 when the water in northern California streams averaged only about 38 percent of normal. It has been used as the reference drought situation in much water resource planning.

Evaporation - The process by which surface or subsurface water is converted to atmospheric vapor.

---

* From Santa Clara Valley Water District's "Glossary of Terms", April, 1977.

Evapotranspiration - Water withdrawn from soil by evaporation and plant transpiration (a consumptive use).

Flood Insurance - The transfer of the risk of monetary loss due to flooding to another in accordance with the National Flood Insurance Program.

Floodplain - The relatively flat area adjoining a river or lake that may be covered by floodwater.

Gradient - The rate of change per unit of length, such as the slope of the land, stream channel, or any surface.

Groundwater - Subsurface water in saturated porous rocks and soils.

Groundwater Basin - Areas where water is stored below the ground surface.

Groundwater Recharge - The process whereby water seeps from the surface down through soil materials to become groundwater.

Groundwater Recharge Basins - Depressions where water is placed so that it can seep into the ground.

Hydrologic Cycle - The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages of precipitation, consequent runoff, streamflow, infiltration and underground movement, eventual evaporation, and reprecipitation.

Hydrology - The applied science concerned with the waters of the earth in all its states - their occurrences, distribution, and circulation through the unending hydrologic cycle.

Hydrology, Groundwater - The branch of hydrology that deals with groundwater, its occurrence, movement, replenishment, and depletion.

Imported Water - Water that is moved from one drainage basin to another. (Example: Water is moved from the Sacramento-San Joaquin Valleys through canals and pipelines into the Santa Clara Valley.)

Infiltration - The movement of water through the soil surface and into the soil.

Injection Well - Well used for introduction water into an aquifer. Technique used to stop seawater intrusion, replenish an aquifer, or dispose of cooling water.

Overdraft - The condition in a groundwater basin where the amount of water withdrawn by pumping exceeds the amount of water replenishing the basin over a long time period.

Perched Groundwater - Groundwater occurring in a saturated zone separated from the main body of groundwater by unsaturated rock (or soil).

Percolation - The movement of water, under natural pressures developed underground, through the interstices of the rock or soil.

Percolation Pond - See Groundwater Recharge Basin.

Permeability - A measure of the ability of a material to convey water.

Piezometric Level - The level to which water will rise in a well that penetrates a confined aquifer.

Point Source - Any discernible confined and discrete conveyance from which pollutants are or may be discharged.

Pollution -The addition of sewage, industrial wastes, or other harmful or objectionable material to water (see also Contamination).

Potable Water - Water which does not contain objectionable pollution, contamination, minerals, or infection and is considered satisfactory for domestic consumption.

Precipitation - The total measurable supply of water received from clouds as rain, snow, hail, or sleet.

Primary Treatment - The first major stage in wastewater treatment, usually sedimentation. Floating and settleable solids are removed in this stage.

Salinity - The concentration of salts dissolved in water.

Secondary Treatment - The second major step in wastewater treatment using biological methods to decompose the organic wastes carried by the water.

Semiperched Groundwater - Shallow groundwater overlying a body of groundwater from which it is not separated by any unsaturated alluvium (perched groundwater but not separated by an unsaturated zone from the main groundwater body; separation is achieved by the nearly impermeable nature of the perching clay layer and if the main groundwater body were drawn down, a true perching condition would result).

Spreading Dam - A low artificial barrier built in a stream to pond water to increase groundwater recharge capacity.

Subsurface Inflow - Underground waters of the hills and mountains or adjacent groundwater basins that move into the groundwater basin under consideration. This water is subsurface outflow from the hills and mountains or the adjacent grondwater basin.

Surface Diversion - The taking of water from a stream or other body of surface water into a canal, pipeline, or other conduit.

Surface Water - Water that rests on the surface of the earth, such as streams and rivers, ponds, lakes, and reservoirs.

Suspended Solids (SS) - Small particles of matter that are carried in suspension in water.

Tertiary - Treatment processes in addition to the normal secondary treatment of wastewaters. Generally, these are chemical and physical processes.

Total Dissolved Solids (TDS) - The amount of organic and inorganic matter (by weight) dissolved in a given quantity of water. It is usually stated in parts per million (ppm) or milligrams per liter (mg/l).

Treated Water - Water that has been treated to make it suitable for domestic service (see Potable Water).

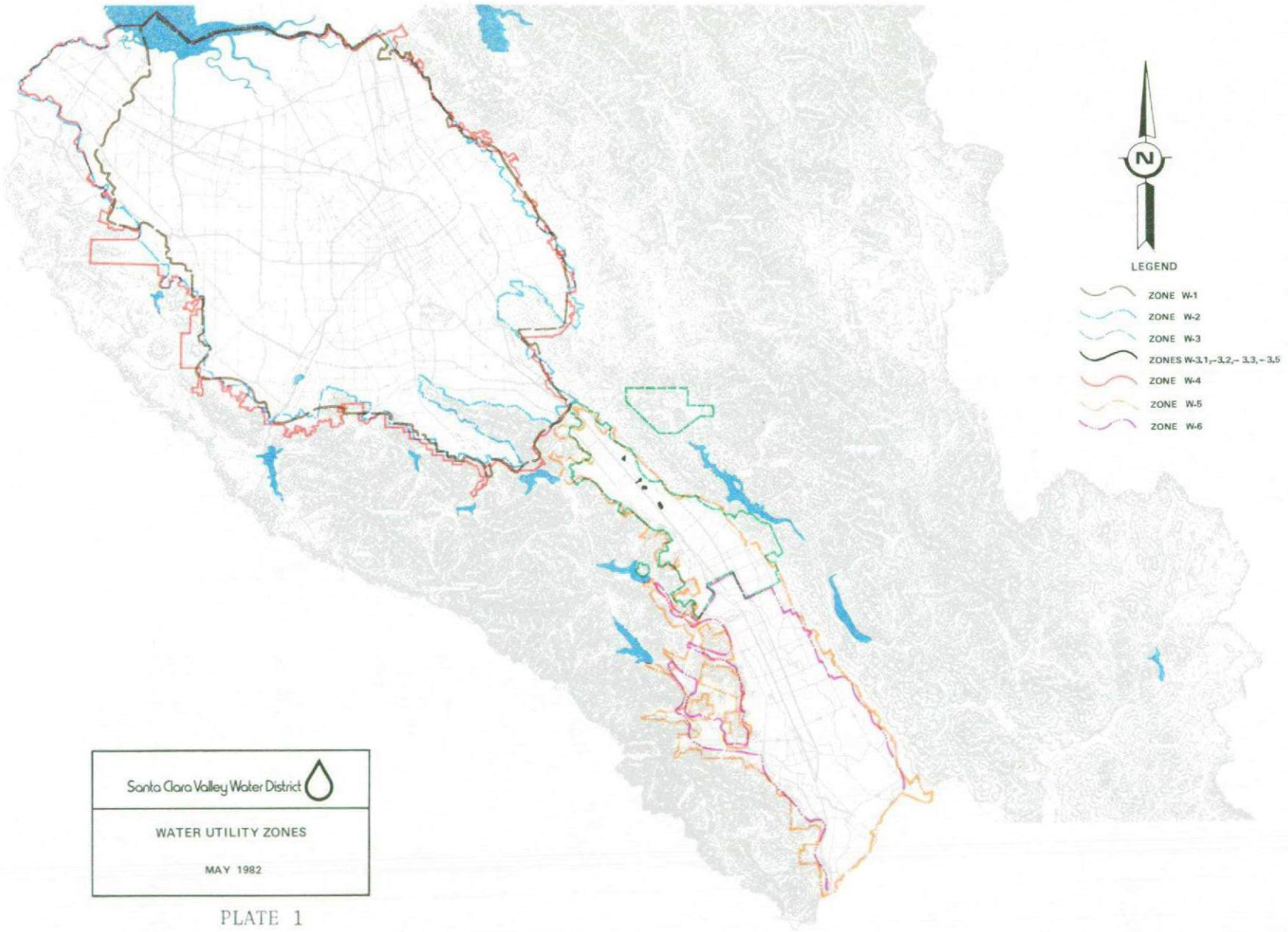
Turbidity - A measure of fine suspended matter (usually colloidal) in liquids. The fine particles may be visible as a bulk unit but are not large enough to be seen as individual particles by the naked eye; in total they restrict the passage of light through the liquid.

Unconfined Aquifer - An aquifer such that the piezometric surface of the groundwater retained within it falls below the bottom of any upper confining bed.

Water Quality - The chemical, physical, and biological properties of water which affect its suitability for use.

Watershed - The land area from which water drains to a given point (a drainage area, drainage basin, or catchment area).

Water Table - The surface where groundwater is encountered in a well in an unconfined aquifer.



Santa Clara Valley Water District

WATER UTILITY ZONES

MAY 1982

PLATE 1

LINES OF EQUAL GROUND WATER ELEVATION ON OCTOBER 1, 1982

Santa Clara Valley Water District

LEGEND

VALLEY FLOOR AREA

–10– LINES OF EQUAL GROUND WATER ELEVATION IN METRES

SCALE IN FEET

0 10,000 20,000 30,000 40,000

PLATE 2

LINES OF EQUAL CHANGE IN WATER ELEVATION FROM OCTOBER 1, 1981 TO SEPTEMBER 30, 1982

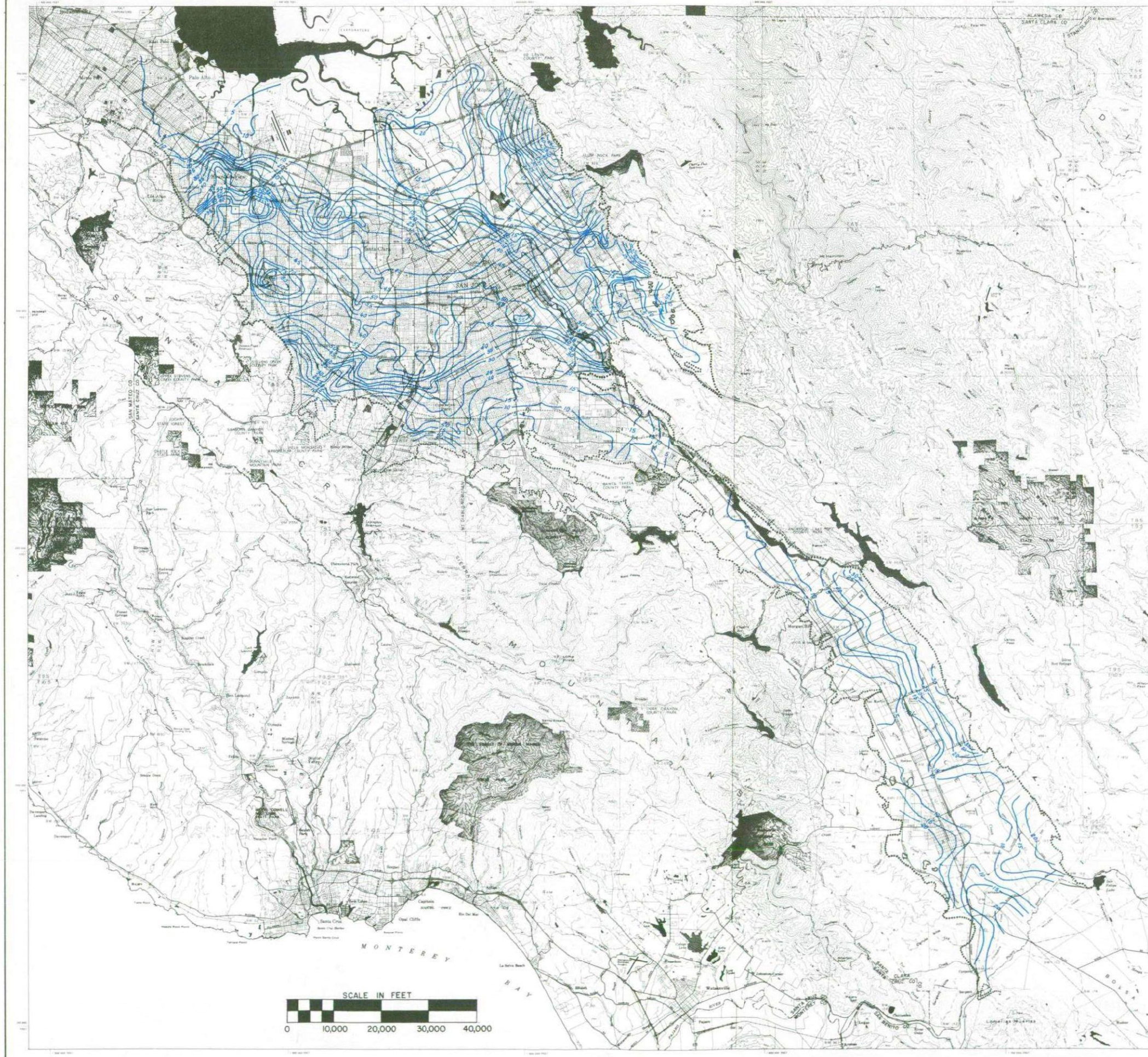
LEGEND

- VALLEY FLOOR AREA
- 20 — LINES OF EQUAL CHANGE IN WATER ELEVATION IN WELLS IN UN-CONFINED ZONE IN METRES
- 20 — LINES OF EQUAL CHANGE IN PIEZOMETRIC LEVEL IN WELLS IN CONFINED ZONE IN METRES
- APPROXIMATE LIMIT OF CONFINED AQUIFER

SCALE IN FEET

0 10,000 20,000 30,000 40,000

PLATE 3



LINES OF EQUAL DEPTHS TO WATER
ON OCTOBER 1, 1981

Santa Clara Valley Water District

LEGEND

VALLEY FLOOR AREA

30 LINES OF EQUAL DEPTH TO WATER

PLATE 4